

WE CLAIM:

1 1. A system for implementing surgical procedures comprising:
2 an ultrasonic surgical handpiece having an end-effector;
3 a generator console for controlling the handpiece;
4 an electrical connection connecting the handpiece and the console, wherein
5 the console sends a drive current to drive the handpiece which imparts ultrasonic longitudinal
6 movement to the end-effector; and
7 a finger-operated switch provided on a housing of the handpiece, the switch
8 activating the handpiece at a first power level if a monitored pressure on the switch reaches
9 a high threshold, and deactivating the handpiece if the monitored pressure reaches a low
10 threshold.

1 2. The system of claim 1 wherein the switch is distally located on the
2 handpiece.

1 3. The system of claim 1 wherein the handpiece is operated at a power
2 level selected from a plurality of power levels if the monitored pressure reaches a specific
3 threshold of a respective plurality of thresholds corresponding to the plurality of power
4 levels.

1 4. The system of claim 1 wherein the pressure is monitored by a sensor
2 located inside the housing of the handpiece selected from a group consisting of an electro-
3 mechanical switch, a force-sensitive resistor, force sensitive capacitor, strain gauge, magnet,
4 ferromagnet, piezo film and piezo ceramic.

1 5. The system of claim 1 wherein the switch comprises a pair of switch
2 button members:

1 6. The system of claim 1 wherein the switch further comprises an
2 inactive center region for resting of a finger and serving as a tactile reference.

1 7. The system of claim 1 wherein the switch is generally user-alignable
2 with the end-effector.

1 8. The system of claim 1 wherein the switch is symmetrically aligned and
2 indexed to the end-effector.

1 9. The system of claim 5 wherein each of the switch button members
2 comprises:

3 an upper surface and a lower surface;
4 a first post and a second post extending outwardly away from the lower
5 surface; and

6 a first raised section and a second raised section on the upper surface, said
7 raised section being supported by a center recessed section formed therebetween.

1 10. The system of claim 9 wherein the first post is disposed generally
2 opposite the first raised section and the second post is disposed generally opposite the second
3 raised section so that the first post is directed toward the interior of the handpiece when the
4 first raised section is depressed and the second post is directed toward the interior of the
5 handpiece when the second raised section is depressed.

1 11. The system of claim 1 wherein the switch is a ring switch with a ring-
2 like circumferential appendage on the handpiece that is located near a distal end of the
3 handpiece.

1 12. The system of claim 11 wherein the ring switch comprises a capacitive
2 transducer having a center ring, an outer layer of elastomer on the exterior of the center ring,
3 and a ring electrode on top of the ring switch.

1 13. The system of claim 11 further including multicolor illumination and
2 a control such that the ring switch becomes illuminated in difference colors corresponding
3 to a plurality of pressure thresholds.

1 14. The system of claim 11 wherein the ring switch is a sensor comprising
2 a piezo portion and a substrate adjacently disposed with the piezo portion, the ring switch
3 outputting a first polarity signal when pressure is applied to the piezo portion and outputting
4 a second opposing polarity signal when pressure is applied to the substrate.

1 15. The system of claim 11 wherein the ring switch is a sensor comprising
2 a first piezo ring, a second piezo ring, and a center ring disposed between the first piezo ring
3 and the second piezo ring, the ring switch outputting a first polarity signal when pressure is
4 applied to the first piezo ring and outputting a second opposing polarity signal when pressure
5 is applied to the second piezo ring.

1 16. The system of claim 11 wherein the ring switch comprises a first seal
2 and a second seal, and a piezo ring disposed between the first seal and the second seal, the
3 ring switch outputting a first polarity signal when pressure is applied in one direction to the
4 piezo ring and outputting a second opposing polarity signal when pressure is applied in
5 another direction to the piezo ring.

1 17. The system of claim 11 wherein the ring switch comprises a pair of
2 outer rings, a center ring disposed between the outer rings, and a pair of flexible rings
3 respectfully located on the exterior of the outer rings to support the center ring with the outer
4 rings, and a pair of piezo rings fixed to two sides of bottom of the center ring.

1 18. The system of claim 11 wherein the ring switch comprises a support
2 ring and a pair of adjacently located activation zones which are circumferential bands serially
3 connected with the support ring.

1 19. The system of claim 18 wherein the activation zones consist of one
2 of an electro-mechanical switch, force sensitive resistors, force sensitive capacitors, strain
3 gauges, magnets, and piezo material.

1 20. The system of claim 18 wherein the ring switch further comprises a
2 middle rib disposed between the activation zones, the middle rib serving as a divider for the
3 activation zones.

1 21. The system of claim 20 further including multicolor illumination and
2 a control so that the middle rib becomes illuminated in difference colors corresponding to
3 a plurality of pressure thresholds.

1 22. The system of claim 18 wherein the ring switch further comprises a
2 distal rib located on a distal end of the activation zones.

1 23. The system of claim 22 further including multicolor illumination and
2 a control so that the distal rib becomes illuminated in difference colors corresponding to a
3 plurality of thresholds.

1 24. The system of claim 18 wherein the ring switch further comprises a
2 proximal rib on a proximal end of the activation zones.

1 25. The system of claim 24 further including multicolor illumination and
2 a control so that the proximal rib becomes illuminated in difference colors corresponding to
3 a plurality of thresholds.

1 26. The system of claim 18 wherein each of the activation zones is further
2 divided into subzones corresponding to variable power levels of the plurality of pressure
3 thresholds.

1 27. The system of claim 1 further comprising switches on opposing sides
2 of the handpiece that generally avoid inadvertent activation.

1 28. The system of claim 1 wherein the switch is a hysteresis switch.

1 29. The system of claim 11 wherein the ring switch further comprises a
2 sliding barrier covering a portion of the circumferential appendage.

1 30. The system of claim 1 wherein the switch provides its switching
2 functionality according to a lagging effect as the monitored pressured on the switch is

3 changed.

1 31. A system for implementing surgical procedures comprising:
2 an ultrasonic surgical handpiece having an end-effector;
3 a generator console for controlling the handpiece;
4 an electrical connection connecting the handpiece and the console, wherein
5 the console sends a drive current to drive the handpiece which imparts ultrasonic longitudinal
6 movement to the end-effector; and
7 a finger-operated switch provided on a housing of the handpiece, the switch
8 activating the handpiece at a first power level and deactivating the handpiece if a low
9 threshold is reached.

1 32. The system of claim 31 wherein the switch is distally located on the
2 handpiece.

1 33. The system of claim 31 wherein the switch further comprises a sensor
2 located inside the housing of the handpiece selected from a group consisting of an electro-
3 mechanical switch, a force-sensitive resistor, force sensitive capacitor, strain gauge, magnet,
4 ferromagnet, piezo film and piezo ceramic.

1 34. The system of claim 31 wherein the switch comprises a pair of switch
2 button members.

1 35. The system of claim 31 wherein the switch further comprises an
2 inactive center region for resting of a finger and serving as a tactile reference.

1 36. The system of claim 31 wherein the switch is generally user-alignable
2 with the end-effector.

1 37. The system of claim 31 wherein the switch is symmetrically aligned
2 and indexed to the end-effector.

1 38. The system of claim 34 wherein each of the switch button members
2 comprises:
3 an upper surface and a lower surface;
4 a first post and a second post extending outwardly away from the lower
5 surface; and
6 a first raised section and a second raised section on the upper surface, said
7 raised section being supported by a center recessed section formed therebetween.

1 39. The system of claim 38 wherein the first post is disposed generally
2 opposite the first raised section and the second post is disposed generally opposite the second
3 raised section so that the first post is directed toward the interior of the handpiece when the
4 first raised section is depressed and the second post is directed toward the interior of the

5 handpiece when the second raised section is depressed.

1 40. The system of claim 31 wherein the switch activates the handpiece at
2 the first power level if a monitored pressure on the switch reaches a high threshold, and
3 deactivating the handpiece if the monitored pressure reaches the low threshold.

1 41. The system of claim 40 wherein the switch is a ring switch with a ring-
2 like circumferential appendage on the handpiece that is located near a distal end of the
3 handpiece.

1 42. The system of claim 41 wherein the ring switch comprises a capacitive
2 transducer having a center ring, an outer layer of elastomer on the exterior of the center ring,
3 and a ring electrode on top of the ring switch.

1 43. The system of claim 41 further including multicolor illumination and
2 a control such that the ring switch becomes illuminated in difference colors corresponding
3 to a plurality of pressure thresholds.

1 44. The system of claim 41 wherein the ring switch is a sensor comprising
2 a piezo portion and a substrate adjacently disposed with the piezo portion, the ring switch
3 outputting a first polarity signal when pressure is applied to the piezo portion and outputting
4 a second opposing polarity signal when pressure is applied to the substrate.

1 45. The system of claim 41 wherein the ring switch is a sensor comprising
2 a first piezo ring, a second piezo ring, and a center ring disposed between the first piezo ring
3 and the second piezo ring, the ring switch outputting a first polarity signal when pressure is
4 applied to the first piezo ring and outputting a second opposing polarity signal when pressure
5 is applied to the second piezo ring.

1 46. The system of claim 41 wherein the ring switch comprises a first seal
2 and a second seal, and a piezo ring disposed between the first seal and the second seal, the
3 ring switch outputting a first polarity signal when pressure is applied in one direction to the
4 piezo ring and outputting a second opposing polarity signal when pressure is applied in
5 another direction to the piezo ring.

1 47. The system of claim 41 wherein the ring switch comprises a pair of
2 outer rings, a center ring disposed between the outer rings, and a pair of flexible rings
3 respectfully located on the exterior of the outer rings to support the center ring with the outer
4 rings, and a pair of piezo rings fixed to two sides of bottom of the center ring.

1 48. The system of claim 41 wherein the ring switch comprises a support
2 ring and a pair of adjacently located activation zones which are circumferential bands serially
3 connected with the support ring.

1 49. The system of claim 48 wherein the activation zones consist of one
2 of an electro-mechanical switch, force sensitive resistors, force sensitive capacitors, strain
3 gauges, magnets, and piezo material.

1 50. The system of claim 48 wherein the ring switch further comprises a
2 middle rib disposed between the activation zones, the middle rib serving as a divider for the
3 activation zones.

1 51. The system of claim 50 further including multicolor illumination and
2 a control so that the middle rib becomes illuminated in difference colors corresponding to
3 a plurality of pressure thresholds.

1 52. The system of claim 48 wherein the ring switch further comprises a
2 distal rib located on a distal end of the activation zones.

1 53. The system of claim 52 further including multicolor illumination and
2 a control so that the distal rib becomes illuminated in difference colors corresponding to a
3 plurality of thresholds.

1 54. The system of claim 48 wherein the ring switch further comprises a
2 proximal rib on a proximal end of the activation zones.

1 55. The system of claim 54 further including multicolor illumination and
2 a control so that the proximal rib becomes illuminated in difference colors corresponding to
3 a plurality of thresholds.

1 56. The system of claim 48 wherein each of the activation zones is further
2 divided into subzones corresponding to variable power levels of the plurality of pressure
3 thresholds.

1 57. The system of claim 31 further comprising switches on opposing sides
2 of the handpiece that generally avoid inadvertent activation.

1 58. The system of claim 31 wherein the switch is a hysteresis switch.

1 59. The system of claim 41 wherein the ring switch further comprises a
2 sliding barrier covering a portion of the circumferential appendage.

1 60. The system of claim 48 wherein the ring switch further comprises a
2 sliding barrier covering at least one of the activation zones.

1 61. A method for controlling an ultrasonic surgical handpiece using a
2 switch located on a housing of the handpiece, comprising the steps of:

3 monitoring pressure applied to the housing using the switch;
4 activating the handpiece at a first power level if the monitored pressure
5 reaches a high threshold; and
6 deactivating the handpiece if the monitored pressure reaches a low threshold.

1 62. The method of claim 61 further comprising the step of operating the
2 handpiece at a power level selected from a plurality of power levels if the monitored pressure
3 reaches a specific threshold of a respective plurality of thresholds corresponding to the
4 plurality of power levels.

1 63. The method of claim 61 wherein the pressure is monitored by a sensor
2 located inside the housing of the handpiece selected from a group consisting of an electro-
3 mechanical switch, a force-sensitive resistor, force sensitive capacitor, strain gauge, magnet,
4 ferromagnet, piezo film and piezo ceramic.

1 64. The method of claim 61 wherein the switch is generally aligned with
2 the blade as the blade is rotated.

1 65. The method of claim 61 wherein the switch provides its switching

2 functionality according to a lagging effect as the monitored pressured is changed.

1 66. An ultrasonic surgical handpiece having a housing with a finger-
2 operated switch located thereon, the switch having a sensor for monitoring pressure thereon
3 so that the handpiece is placed in an operative mode when the sensor monitors a pressure
4 above a first threshold and is placed in an inoperative mode when the pressure is below a
5 second threshold.

1 67. The handpiece of claim 66 wherein the first and second thresholds are
2 the same.

1 68. The handpiece of claim 66 wherein the first threshold is at a higher
2 pressure than the second threshold.